

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

PATENT

In re application of: ZHU et al.

Attorney Docket No.: LAM1P147/P0675

Application No.: 09/782,185

Examiner: CHEN, Kin-Chan

Filed: February 12, 2001

Group: 1765

Title: UNIQUE PROCESS CHEMISTRY FOR
ETCHING ORGANIC LOW-K MATERIALS

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DECLARATION UNDER 37 CFR § 1.132

Assistant Commissioner for Patents
Washington, D.C. 20231

Sir:

I, Helen Zhu, declare as follows:

I am a co-inventor in the above-identified patent application.

I am a citizen of the United States of America.

I received a BS degree from University of California Santa Barbara.

I have worked for Lam Research Corporation from 1988 doing research and development in Plasma Etch.

I have reviewed the patent US. Patent No. 6,194,128 to Tao et al (Tao) and US Patent No. 6,080,529 to Yee et al. (Yee).

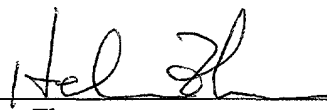
Our invention addresses a method of reducing micromasking by providing a small amount of CH_3F as an additive to an etchant gas. The amount of CH_3F is kept low enough so that fluorine from the CH_3F is not used to accomplish the main etch, but is high enough to reduce micromasking. By keeping the amount of CH_3F this low, bowing is reduced. In addition, the low concentration of CH_3F also helps to maintain desired CD. An example of a flow ratio that would help to accomplish this would be a CH_3F to total etchant gas flow ratio of about 0.25% to about 2%.

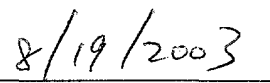
In my understanding of Tao, the fluorine from CHF_3 is used for the main etch and therefore is provided at a higher concentration than the concentration used in the invention. I do not feel that it would be obvious to use the described flow ratios of Tao to obtain the flow ratios of the invention, since Tao uses the fluorine for performing the main etch. Although the use of fluorine for the main etch may have been known, the use of fluorine of such a small concentration that the fluorine is not used to accomplish the main etch but is of sufficient concentration to reduce micromasking was not known or made obvious. As a result, I do not feel that it would be obvious to combine Tao with Yee to obtain the invention as claimed.

Micromasking has been a problem during the etching process. LAM Research has had different researchers attempt to solve this problem. Some of these researches worked on this project before me. I was assigned to find a solution to this problem. Analysis was performed to find the cause of the micromasking. Through experiments the cause of the micromasking was determined. We believed that providing fluorine would solve the micromasking problem. At first we used fluorine concentrations in the range described by Tao. We found that we could not maintain the desired critical dimensions using such concentrations of fluorine. Various attempts were made to reduce the fluorine concentration using different fluorine sources. Comparisons of radical densities and plasma spectrum of different fluorine sources were also made. After more than 6 months of experiments, it was found that CH_3F at a low flow ratio was able to both remove micromasking and provide desired CD

without bowing.

I hereby declare that all statements made herein of my own knowledge are true and that all statements made on information and belief are believed to be true. I further declare that these statements are made with the knowledge that willful false statements and the like so made are punishable by fine or imprisonment, or both (under Section 1001 of Title 18 of the United States Code), and that such willful false statements may jeopardize the validity of the application or any patent issued thereon.


Helen Zhu


Date